

JUE WANG

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Research Interests

- Medical Image Processing
- Data Analysis
- Mathematics in Health Care
- Fluid Dynamics and Turbulence

Goal: To develop effective models and methods that help access clinically-meaningful information embedded in the complex data, in order to assist medical diagnosis and cancer detection.

Education

- Ph.D. in Mathematics**, University of Wisconsin - Madison 2007
Dissertation: *On Lower Branch Exact Coherent Structures in Turbulent Shear Flows*
- B.S. in Mathematics**, Peking University (Beida), Beijing, China 2001

Employment

- Associate Professor**, Union College 2017 – present
- Assistant Professor**, Union College 2011 – 2017
- Visiting Assistant Professor**, Union College 2007 – 2011

Grants

- New York Six Academic Collaboration Grant** 2020 – 2022
Collaborative Partnership to Foster Liberal Arts Education and Research in Applied Mathematics
- Union College IEF Teaching with Technology Grant** 2020 – 2021
- NSF – MRI (NSF 1919570) \$384,725** 09/2019 – 08/2022
Co-PI
Acquisition of a High-speed Volumetric Particle Image Velocimetry System for Fluid Mechanics Research and Research Training in Science, Mathematics, and Engineering
- Union College Faculty Research Grant** 2018 – 2019
Enabling Real-Time Volumetric 3D Ultrasound Imaging at Low Cost
- Union College MOSH Maker Co-Curricular Activity Grant** 2018 – 2019
Bringing Mathematics to Life with 3D Making
- Union College Faculty Research Grant** 2017 – 2018
Cancer Classification via Convolutional Neural Networks
- NIH – NIBIB (NIH 1R15EB012299–01A1) \$250,000** 06/2011 – 05/2016
Funding rate: 9.7%
Principal Investigator
Artifact-Free Reconstruction of Medical Imaging Information

Union College Internal Education Foundation Grant	\$10,095	2016
Co-Investigator, Faculty of The MakerWeb Consortium		
<i>Acquisition of a Laser Cutter to Enhance MakerWeb Curricular Activities</i>		
Union College Faculty Research Grant		2010 – 2011
<i>Attenuation Compensation in Ultrasound Imaging</i>		

Honors and Awards

Invited Speaker , Data Science for Social and Environmental Justice Writing Group		2021
Faculty Development Institute Incubator , Union College		2020
Invited Speaker , Leaps of Faith: 8 Stories about Cultivating Complex Thinkers		2019
Invited Leader , Women in Engineering (WIE) Networking, IEEE LSC		2018
NSF SIMIODE Curriculum Development in STEM Effort		2018
Mellon Presidential Project for Global Learning Faculty Study Tour, Union College		2016
Faculty Development Institute for Teaching with Technology, Union College		2015
NSF Travel Award to Casablanca International Workshop on Mathematical Biology		2011
NSF Travel Award to the Workshops on Inverse Problems and Applications, MSRI		2010
NSF Travel Award to the Workshop on Mathematical Problems in Industry		2009
First Place Poster Prize in SIAM Conference on Applications of Dynamical Systems		2007
AWM Travel Award to SIAM Conference on Applications of Dynamical Systems		2007
Excellence in Teaching Award , University of Wisconsin-Madison		2006
Letters and Sciences Teaching Fellow , University of Wisconsin-Madison		2004
Elizabeth Hirschfelder Fund Scholarship , University of Wisconsin-Madison		2003
Superior Teaching Assistant , University of Wisconsin-Madison		2001 – 2005
2nd Place Award in The Mathematical Contest in Modeling (MCM), China		1999
Jiuzhang Mathematical Scholarship , Peking University, China		1998

Refereed Publications

25. Mathematics for Sustainable Humanity – Population, Climate, Energy, Economy, Policy, and Social Justice, *Foundations for Undergraduate Research in Mathematics*, Springer, forthcoming.
24. A novel grid regression demodulation method for radiographic grid artifact correction (with Y. Yu), *Medical Physics*, vol. 48, no. 7, 3790–3803, 2021.
23. Coupled active contours for clue cell segmentation from fluorescence microscopy images (with Y. Yu), *BIOSTEC Volume 2: Bioimaging*, 144–151, 2021.
22. Detection of filamentous microorganisms in fluorescence microscopy images (with Y. Yu), *Proc. IEEE Eng. Med. Biol. Soc.*, 1895–1898, 2020.
21. Pandemic modeling – Ebola, COVID-19, and many more, *SIMIODE: Systemic Initiative for Modeling Investigations and Opportunities with Differential Equations*, 7518, 2020.

20. Morphological rank-space segmentation of clumped filaments in fluorescence microscopy images (with Y. Yu), *Proc. ICCM*, 777–786, 2019.
19. Automated enumeration and classification of bacteria in fluorescent microscopy imagery (with Y. Yu), *Proc. IEEE LSC*, 57–60, 2018.
18. The next time you play HvZ, think about differential equations, *SIMIODE: Systemic Initiative for Modeling Investigations and Opportunities with Differential Equations*, 5214, 2018.
17. Inner ear drug delivery for treating hearing loss, *SIMIODE: Systemic Initiative for Modeling Investigations and Opportunities with Differential Equations*, 5069, 2018.
16. Differential equations and resonance – can a human singing voice shatter a wine glass? *SIMIODE: Systemic Initiative for Modeling Investigations and Opportunities with Differential Equations*, 5051, 2018.
15. Optimum degrading via robust PCA in digital radiography (with Y. Yu), Accepted, 2018.
14. Modeling cancer growth with differential equations, *SIMIODE: Systemic Initiative for Modeling Investigations and Opportunities with Differential Equations*, 4845, 2018.
13. Variational principle for ultrasonic artifact correction and signal segmentation (with Y. Yu), *Proc. Asilomar Conference on Signals, Systems, and Computers*, 1486–1490, 2017.
12. Enclosure transform for interest point detection from speckle imagery (with Y. Yu), *IEEE Transactions on Medical Imaging*, vol. 36, no. 3, 769–780, 2017. *Impact Factor: 6.685*
11. Automatic detection of direct radiation for digital fluoroscopy optimization (with Y. Yu and S.T. Acton), *Proc. IEEE ICIP (Image Processing)*, 3379–3383, 2016. *Acceptance rate: 45%*
10. X-ray collimator shutter detection by active-rods (with Y. Yu and S.T. Acton), *Proc. IEEE ICIP (Image Processing)*, 2350–2354, 2016. *Acceptance rate: 45%*
9. Automatic contrast enhancement by variational minimax optimization (with Y. Yu), *Proc. IEEE ICIP (Image Processing)*, 173–177, 2015. *Acceptance rate: 45%*
8. The asymptotic eigenvalues of first-order spectral differentiation matrices (with F. Waleffe), *Journal of Applied Mathematics and Physics*, vol. 2, no. 5, 176–188, 2014.
7. Heel effect adaptive flat field correction of digital x-ray detectors (with Y. Yu), *Medical Physics*, vol. 40, no. 8, 081913, 2013. *Impact Factor: 3.177*
6. Beam hardening-respecting flat field correction of digital x-ray detectors (with Y. Yu), *Proc. IEEE ICIP (Image Processing)*, 2085–2088, 2012. *Acceptance rate: 45%*
5. Despeckling trilateral filter (with Y. Yu and G. Dong), *Proc. IEEE IVMS (Image, Video, and Multidimensional Signal Processing)*, 42–47, 2011.
4. Backscatter-contour-attenuation joint estimation model for attenuation compensation in ultrasound imagery (with Y. Yu), *IEEE Transactions on Image Processing*, vol. 19, no. 10, 2725–2736, 2010. *Impact Factor: 9.34*
3. Homogenization of the equations governing the flow between a slider and a rough spinning disk (with D. Cargill *et al.*), *MPI Workshop Report, MIIS Eprints Archive*, 2009.

2. Lower branch coherent states in shear flows: transition and control (with J. Gibson and F. Waleffe), *Physical Review Letters*, 98:204501, 2007. *Impact Factor: 8.839*
1. Transition threshold and the self-sustaining process (with F. Waleffe), *IUTAM Symposium on Laminar-Turbulent Transition and Finite Amplitude Solutions*, Springer, 85–106, 2005.

Research Presentations

Coupled Active Contours for Clue Cell Segmentation from Fluorescence Microscopy Images, international Conference on Bioimaging, February 12, 2021.

Detection of Filamentous Microorganisms in Fluorescence Microscopy Images, International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC), July 20, 2020.

Computational Analysis of the Spiral Intestine in Leucoraja Erinacea (poster), Northeast Society for Developmental Biology Meeting, Woods Hole, MA, April 6, 2019.

Automatic Detection of Breast Masses and Location of the Prostate, AMS Special Session on Statistical, Variational, and Learning Techniques in Image Analysis and their Applications to Biomedical, Hyperspectral, and Other Imaging, AMS-MAA Joint Mathematics Meetings, Baltimore, MD, January 19, 2019.

Automatic Detection of Direct Radiation for Digital Fluoroscopy Optimization (poster), IEEE Life Sciences Conference, Montréal, Canada, October 29, 2018.

Variational Principle for Ultrasonic Artifact Correction and Signal Segmentation, Asilomar Conference on Signals, Systems, and Computers, Pacific Grove, CA, October 31, 2017.

Detecting Breast Masses and the Location of the Prostate, SIAM Annual Meeting, Pittsburgh, PA, July 14, 2017.

Automatic Detection of Direct Radiation for Digital Fluoroscopy Optimization (poster), 2016 IEEE ICIP, Phoenix, AZ, September 27, 2016.

X-ray Collimator Shutter Detection by Active-Rods (poster), 2016 IEEE ICIP, Phoenix, AZ, September 26, 2016.

A Weak Form Attenuation Compensation Model for Ultrasonic Imagery, SIAM Conference on Imaging Science (IS16), Albuquerque, NM, May 25, 2016.

Artifact Correction in Ultrasound Images with Application in Prostate Cancer Treatment, GE Global Research Center, Niskayuna, NY, October 22, 2015.

Automatic Contrast Enhancement by Variational Minimax Optimization (poster), 2015 IEEE ICIP, Québec City, Canada, September 28, 2015.

The Asymptotic Eigenvalues of First-Order Spectral Differentiation Matrices, 2014 International Conference on Applied and Engineering Mathematics, Shanghai, China, April 17, 2014.

Heel Effect Adaptive Flat Field Correction of Digital X-ray Detectors, SIAM Conference on Computational Science & Engineering, Boston, MA, February 26, 2013.

Beam Hardening-respecting Flat Field Correction of Digital X-ray Detectors (poster), 2012 IEEE ICIP, Orlando, FL, October 2, 2012.

Attenuation Compensation in Ultrasound Imaging, SIAM Conference on Imaging Science (IS12), Philadelphia, PA, May 20, 2012.

3D Vascular Segmentation Using A Sequential Monte Carlo Approach, Casablanca International Workshop on Mathematical Biology, Casablanca, Morocco, June 22, 2011.

Despeckling Trilateral Filter, 2011 IEEE IVMSWP Workshop, Ithaca, NY, June 16, 2011.

Blood Vessel Segmentation in Volumetric Ultrasound, Joint Mathematics Meetings, New Orleans, LA, January 8, 2011.

Ultrasound Image Segmentation and Attenuation Estimation, SIAM Annual Meeting, Pittsburgh, PA, July 15, 2010.

Attenuation Compensation and Boundary Segmentation in Ultrasound Imaging, University of Wisconsin-Madison, WI, November 6, 2009.

BCA Joint Estimation Method for Attenuation Compensation in Ultrasound Images, SIAM Conference on Mathematics for Industry: Challenges and Frontiers (MI09), San Francisco, CA, October 9, 2009.

Correction of Shadowing and Enhancement Artifacts in Ultrasound Images, Hudson River Undergraduate Mathematics Conference XVI, April 18, 2009.

Lower Branch Exact Coherent Structures in Turbulent Shear Flows, Project NExT Young Mathematicians' Network Poster Session at the Joint Mathematics Meetings, Washington D.C., January 5, 2009.

Minimization Problem in Image Restoration, Union College, September 22, 2008.

Lower Branch Exact Coherent Structures – Backbone of The Separatrix (poster), AWM Workshop in conjunction with the SIAM Conference on Applications of Dynamical Systems, Snowbird, Utah, May 30, 2007.

R^{-1} Scaling of Lower Branch Coherent States in Plane Couette Flow, SIAM Conference on Applications of Dynamical Systems, Snowbird, Utah, May 29, 2007.

Global Balance of Energy and Scalings, University of Wisconsin-Madison, November 2006.

R^{-1} Scaling of The Lower Branch Exact Coherent Structures, APS Division of Fluid Dynamics 57th Annual Meeting, Seattle, WA, November 2004.

Teaching Presentations

Minervas Large-Scale Societal and Environmental Challenges Course Presentation, President's Council Meeting, Union College, January 21, 2021.

Silver Linings: Stories of Innovation at Union College, December 10, 2020.

Engaging Students to Connect Mathematical Concepts, Part of 8x8 Leaps of Faith: 8 Stories about Cultivating Complex Thinkers for a Messy World, Union College, April 24, 2019.

Panel Discussion for New Faculty: Advice on Teaching and Pedagogy, Union College, August 28, 2018; September 6, 2019.

Big Ideas, Experiences and Takeaways, Faculty Development and Learning Presentation, February 9, 2016.

Read it, Calculate it, Build it: Student Learning in the 3rd Dimension, Faculty Development and Learning Presentation, February 2, 2016.

Committee on Teaching Panel: Adjusting to Union, Union College, February 10, 2012.

Abacus: History and Use, Thurston House Seminar Talk and Discussion, Union College, April 11, 2008.

Mathematics and Physics behind Golf Ball Dimples, Union College, October 11, 2007.

Professional Service

Reviewer, IEEE Access

Reviewer, IEEE ICIP

Reviewer, IEEE Transactions on Medical Imaging

Reviewer, BMC Medical Research Methodology

Reviewer, Asian Journal of Mathematics and Computer Research

Judge, SIMIODE Challenge Using Differential Equations Modeling (SCUDEM), 2020

Program Committee and Reviewer, The 16th Australasian Data Mining Conference, 2018

Session Chair, SIAM Annual Meeting, July 2017

Session Chair, SIAM Conference on Imaging Science, May 2012; May 2016

Committee and Session Chair, Hudson River Undergraduate Mathematics Conference XVI 2009; XXII 2015

Session Moderator, Second Annual Upstate NY Undergraduate Research Conference, 2012

Co-Organizer, Skidmore-Union Network Lecture, April 12, 2012

Committee and Session Chair, The Thirteenth Union College Mathematics Conference, April 30 – May 1, 2011

Departmental and College Service

Supervising Undergraduate Research, 2008 – present

Undergraduate summer research: 19 students (146 student weeks)

Summers 2011, 2012, 2013, 2017, 2018, 2020, 2021

Senior theses and other research projects: 49 students (60 academic terms)

Supervisor, The Mathematical Contest in Modeling (MCM), 2008 – present

Meritorious Winner (top 10%): 2008, 2009, 2010, 2014, 2015

Honorable Mention (top 40%): 2011, 2013

Successful Participant: 2012, 2016, 2017

MAA Seaway Representative, 2015 – present

Career Center Representative, 2017 – present

Transfer Coordinator, 2021 – present

Committee on Teaching and Advising, 2021 – present

College Writing Board Committee, 2021 – present
Co-Chair, The President’s Commission on the Status of Women, 2013 – 2015
Research Seminar Organizer, 2009 – 2010, 2014 – 2015
Student Seminar Organizer, 2008 – 2009, 2019 – 2020
Curriculum Steering Committee, 2020 – 2021
Admissions Liaison, 2017 – 2020
Actuarial Advisor, 2011 – 2013
Graduate School Advisor, 2007 – 2009

Teaching Experience (Union)

MIN 203: Climate Change: Knowledge Empowers Action (team-taught)
MTH 063: Mathematics of Sustainability
MTH 110: Differential Calculus
IMP 111: Integrated Mathematics and Physics (team-taught)
IMP 121: Integrated Mathematics and Physics 2 (team-taught)
MTH 113: AP Calculus
MTH 115: Differential Vector Calculus and Matrix Theory
MTH 115H: Enriched Differential Vector Calculus and Matrix Theory
MTH 117: Integral Vector Calculus
MTH 130: Ordinary Differential Equations
MTH 138: Methods of Applied Mathematics 1
MTH 197: Discrete Mathematics
MTH 234: Differential Equations
MTH 238: Methods of Applied Mathematics
MTH 295H/296H: Mathematics Honors Independent Project
MTH 334: Partial Differential Equations
MTH 340: Linear Algebra
MTH 490: Independent Study
MTH 497/498/499: Mathematics Senior Thesis
IDM 487/488/489: Interdepartmental Senior Thesis (team-taught)